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Posted Date: 9 July 2024

doi: 10.20944/preprints202407.0664.v1

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Socioeconomic Characteristics And Satisfaction Level Across Forest Products And Vegetable Farming Of The Agroforestry Community In Khost Province, Afghanistan

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Abstract: Agroforestry practices evolve with the development of basic and advanced facilities, changes in natural and artificial factors of land use change. The study aims to examine the socioeconomic characteristics and compare satisfaction levels across forest products and vegetable farming of the agroforestry community in Khost Province. Data were collected from 662 farmers and was analyzed using univariate Analysis of Variances (ANOVA) and Multivariate Analysis of Variances (MANOVA). The results found that forest and vegetable products, including fruits, berries, herbs, mushrooms, wild animals, oils, wood, honey, okra, eggplant, carrot, cucumber, pine nuts, pepper, and timber has different impact in terms of satisfaction with basic and advanced facilities, knowledge about land use and impacts, natural and artificial factors of land use change, and positive and negative impact of land use change. The limitation of the study included an absence of exogenous factors in the model such as climate change, financial conditions, market fluctuations, regulatory system, an area in which the study is selected, research design, and current condition of endogenous factors. Overall, agroforestry practices can improve the socioeconomic development of agroforestry-dependent communities in Khost Province, Afghanistan. This study provided useful insights for policymakers and development practitioners to promote agroforestry practice adoption and improve the socioeconomic development of agroforestry-dependent communities. Future works could explore the implications of agroforestry practices on the socioeconomic development of other dependent communities in Afghanistan.

Keywords: Agroforestry practices; socioeconomic development; natural resources; farmers; satisfaction level

1. Introduction

Political instability and destruction have reduced Afghanistan, a once progressive country that engaged in large-scale food production (specifically fruits), to a war zone. To date, Afghanistan ranks 155 on the Global Poverty Index, 0.349 on the Human Development Index, and 0.310 on the Gender Development Index. This appalling situation results from continuous environmental degradation rather than insufficient financial resources. In terms of skills and education, Afghanistan lacked the manpower of educated women to bridge this gap and develop an environmentally responsible community [1]. Agroforestry practices have positively impacted the socioeconomic development of

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dependent communities worldwide [2,3]. Agroforestry, as a sustainable land use approach that combines trees, crops, and livestock within a unified management framework, holds the potential to address challenges related to food security, poverty, and environmental sustainability in developing countries [4,5]. However, there is a notable lack of research on the economic and social advantages of agroforestry practices in Afghanistan, even though it has been a vital income source for rural communities for centuries [6].

Conceptually, agroforestry can catalyze economic, social, and environmental progress. One study provides a possible solutions towards livelihood security and resilience to climate change i.e., trees at farms [7]. By employing qualitative and quantitative research methods, [7] highlighted the benefits of agrofrestry as shade and fruit and the main tree species favourable to grow in semi-arid Isiolo County, Kenya as mango, papaya, banana, guava, and neem. The study also highlighted the average scores of all five livelihood capital (financial, human, social, physical, and natural capital) was 10% higher for households practising agroforestry, indicating to have more resilient livelihoods [7]. Another study highlighted the importance of tress as a source of fuelwood and fodder for rural populations in Himalayas, India [8]. The study argued that smallholders can enhance resilience to climate change by adopting full dependency on natural resources, by avoiding the risk of total crop yield losses, and by reducing the time and effort needed to collect resources from outside the farm through the utilizing the fuelwood and fodder in mountainous regions. In this vein, community uplift would provide the public with socioeconomic and environmental measures. The initiation of such agroforestry projects can advance the Khost province to new levels. Despite addressing the environmental degradation caused by land use change and deforestation [9], the impact of agroforestry practices on dependent communities' socioeconomic development in Khost Province, Afghanistan remains under-examined. The current work bridged the literature gap by investigating the impact of agroforestry practices on the socioeconomic development of dependent communities in Khost Province.

The value of agriculture and its domestication must be supported through efficient preservation practices and other associated approaches for human development. Food insecurity was initially resolved via sufficient food resources, which resulted from food production and stability. Nevertheless, agriculture gradually declined with high population growth and poor yields or resources. Subsequently, agricultural production, such as agroforestry was conceptualized to compensate for the greenery lost through environmental degradation. The recent decline of wheat (a staple food in Afghanistan) in agricultural production necessitated a novel and evolved approach, such as agroforestry. Past research on the impact of domesticating trees similar to agriculture fields revealed positive results from production to the overall effect of greenery, which expanded with the increasing number of trees. As evidenced by past studies, the trees cultivated by primitive communities denoted the highest production level with notable success [10].

1.1. Socioeconomic Aspects of Agroforestry

Most agroforestry studies proved to be descriptive or prescriptive. Current agroforestry practices are described or prescribed to address specific land-use issues. Overall, economic references entail benefit-cost analysis, the relative profitability of different systems, and (in some cases) distributive and organizational issues [11]. An agroforestry system is expected to generate (i) an optimal output value at the exact resource cost or (ii) the same output value at a lower resource cost than a single crop system [12]. Economic benefits can be gained through agroforestry, which integrates trees and shrubs with other agricultural enterprises and provides farmers with additional income [13]. As farm labour is spread throughout the year, existing businesses can increase agricultural production and protect the environment by promoting agroforestry species on private farmlands that are not typically used for field crops [14,15]. As evidenced in past research, the introduction of multipurpose trees (mulberry trees) for sericulture could economically and environmentally benefit an agroforestry system compared to mono-cropping, where only one plant type is grown [16].

Agroforestry systems maximize land use, where every area is deemed suitable to cultivate valuable plants. Perennial, multiple-purpose crops that are planted once but yield benefits over time are emphasized [17]. Nevertheless, economic analysis of agroforestry and its theoretical foundation remains lacking due to the intricacies underpinning such assessments [6,18,19]. The paucity of economic agroforestry valuations can be partially explained by the spatial and temporal complexity of agroforestry systems [20], and the multiple inputs and outputs characterizing agroforestry [21].

The economic benefits of agroforestry have been extensively researched. For example, agroforestry systems were found to be more productive by 36% to 100% compared to monocultures, and the crop component yielded higher returns compared to negative returns from the tree component in agroforestry [22]. Studies conducted for comparison of agroforestry systems and business-as-usual agricultural practices indicated that the financial value of output produced in Mediterranean agroforestry systems are higher than the corresponding agricultural system [23]. However, in terms of profitability, the agricultural systems in Atlantic and Continental regions tended to be relatively more profitable. Overall, higher economic gain is reflected through the reduced externalities of pollutions from nutrient and soil losses and increased advatanges from carbon capture and storage linked with agroforestry landscapes [23]. Studies conducted on the diffusion of agroforestry systems highlighted the positive and relevant impact on the stocking rate (heads/ pasture area) and a shift from cattle raising activities to other high gross added value activities [24]. As a unified system with suitable methods to improve agricultural productivity and the natural environment, agroforestry can sustainably enhance food production and farmers' economic conditions worldwide by positively contributing to soil fertility and household income [5]. Agroforestry practices and their symbiotic effects on improved crop growth and yield are widely recognized in addition to environmental, social, and economic aspects.

It is deemed challenging to develop and distribute agroforestry as a viable means for farmers in diverse ecological and socioeconomic contexts. Following [25], agroforestry technology can only impact land management, productivity, or income with wide acceptance by farmers. Based on past literature [26]. farmers' socioeconomic characteristics, resource availability, extension services, infrastructure, and markets render agroforestry adoption a complex process. The development of a novel input-output mix of annuals, perennials, green manure, fodder, and other components renders the adoption of agroforestry complex and challenging, specifically when different agroforestry technologies require multiple operations and management techniques. Thus, the three components of feasibility, profitability, and accessibility were considered in agroforestry adoption [21].

This study aims to examine the impact of agroforestry practices on dependent communities' socioeconomic development in Khost Province, Afghanistan. The objectives are two-fold; to (i) ***examine the socioeconomic characteristics, and (ii) compare a satisfaction level across forest products and vegetable farming of the agroforestry community in Khost Province***.

2. Materials and Methods

2.1. Study Area

The study was conducted in five districts - Gurbuz, Khost "Matun," Mandozayi, Musakhel, and Qalandar - of Khost Province (Figure 1). Khost Province is situated in Southeastern Afghanistan and is primarily characterized by the Khost Valley and the encompassing mountains. Rangelands stretch from Gurbuz district in the south to Jaji Maydan district in the north. The Khost Valley and Bak areas support rain-fed and intensively irrigated crops. Natural forests line the border with the Durand Line and Paktia province. Afghanistan's Khost Province lies at an elevation of approximately 1,180 meters above mean sea level, positioned between 33°59 and 33°46 North latitudes and 69°19 and 70°21 East longitudes. The population stands at 614,584 (2018), encompassing an area of 4,284.34 km².

The combined forest and shrub cover across these districts spans 365.82 km², which represents 23.62% of the entire province's geographical area. Concerning forest canopy density classes within this province, they are primarily categorized as closed forests. The total forest area in Khost province

 doi:10.20944/preprints202407.0664.v1

measures 1,200.88 km². This region boasts abundant natural resources, enabling extensive agroforestry activities to be undertaken.

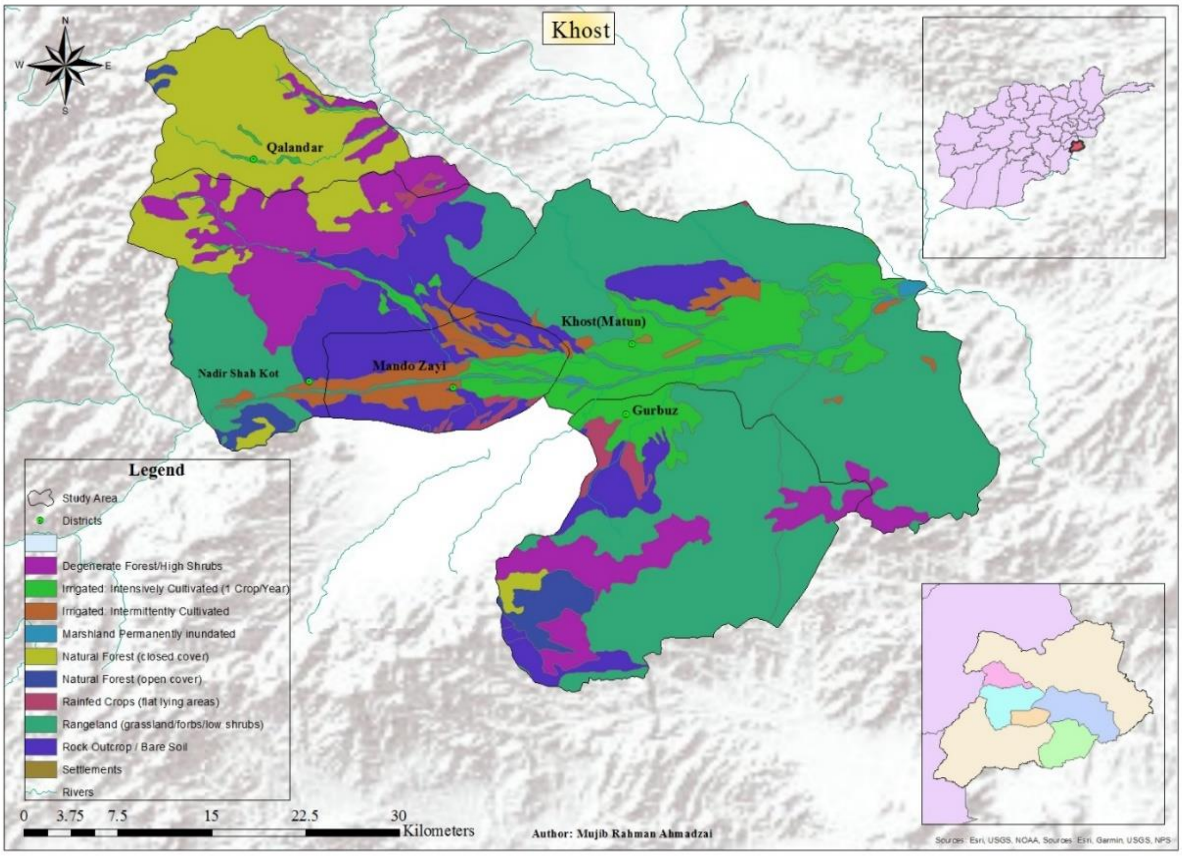

Figure 1. The location of Khost Province (Specific Research Area) in Afghanistan and the current physical situations such as river lines, build-up, Forest and shrubs, Barren Land etc. effects and the location of sampling sites.

2.2. Methods

This study utilized a quantitative approach to assess the impact of agroforestry practices on the socioeconomic development of dependent communities in Khost Province, Afghanistan. The total population of Khost 'Matun', Manduzay, Gurbuz, Musekhel, and Qalandar are 161,780, 66,020, 30,670, 48,000, and 11,970 respectvely. Stratefied sampling technique was used to determine the sample size obtained from each distribution. Agroforestry-practicing farmers in the province denoted the study population, with a sample size of 662 computed with a 1% error and 99% confidence interval. A structured questionnaire containing eight sections, such as sociodemographic information, economic activity, respondent's satisfaction with the level of facilities and infrastructure in their residential area, knowledge of land use change and impacts, factors of land use change, and economic change served as the primary data collection tool. A cross-sectional research design was used to gather data at one point in time. Ten students, four lecturers, and two administrative managers assisted in collecting the data to ensure data precision and reduce cost and time. The survey data were subsequently analyzed via univariate ANOVA and multivariate ANOVA (MANOVA) to determine the impact of different agroforestry practices on dependent communities' socioeconomic development.

The study also highlighted several limitations that could be further examined in future works. For example, potential scholars can explore factors beyond land use change, such as climate change, shifts in policies and regulations, and changes in financial support available to farmers and agroforesters, which may affect the socioeconomic characteristics of agroforestry systems in dependent communities of Afghanistan. An experimental or longitudinal design can also be employed to examine the long-term effects of such environmental shifts. Moreover, the current work can be replicated in other areas and provinces in Afghanistan to increase outcome generalizability. Future researchers can also interview farmers and agroforesters to elicit the practices used and their potential benefits and drawbacks for enhanced research objectivity and generalizability.

2.3. Exploratory Factor Analysis & Reliability of Instruments

Exploratory factor analysis via principal components was used as the extraction method, while Varimax served as the rotation method to determine the factors of the following variables: 'satisfaction with the level of facilities and infrastructure', 'knowledge about land use change', and 'factors of land use change. Questions or items with a factor loading under 0.60, which did not fall into the underlying constructs, were excluded. All the construct questions revealed a factor loading above 0.60 and were included in the factor extracted. Particularly, all the variables were extracted with over 60% of variances explained by factors measuring the constructs. The reliability test was assessed using Cronbach's alpha upon extracting the factors (Table 1). In line with [27], Cronbach's alpha score of all constructs exceeded the threshold level of 0.70. Hence, all the factors extracted revealed good reliability to commence with the analysis..

Table 1. Exploratory factor analysis & instrument's reliability result.

Construct	**Factor extracted**	**Explained variances %**	**α value**
Satisfaction with Residence & Infrastructure	Satisfaction with Basic Facilities	52.08%	0.754
	Satisfaction with Advanced Facilities	13.97%	0.864
Knowledge of Land Use Change & Impacts	Knowledge of Land Use Change & Impacts	61.13%	0.868
Factors of Land Use Change	Natural Factors	53.52%	1.000
	Artificial Factors	20.28%	0.833
Impact of Land Use Change	Negative Impact of Land Use Change	54.05%	0.907
	Positive Impact of Land Use Change	14.54%	0.917

3. Results

3.1. Demographic Characteristics

Frequency distribution was designed to describe the frequency and percentage of respondents across different demographic characteristics (Table 2). Results indicated that around two-thirds of the respondents were equally distributed among the age groups between 25 to 34 years old (35.5%) and between 15 to 24 years old (35.4%). Almost 92% of respondents were male. Almost two-thirds of the respondents were married (68.6%), while 30% of respondents were single. Almost all respondents were Pashtun (97.8%). Furthermore, most of the respondents had more than 20 members in their household (29.1%), followed by respondents having 10 to 14 members (26.6%) and respondents having 5 to 9 members (22.0%). Lastly, a majority of the respondents have no membership in any association (73.9%).

Table 2. Demographic characteristics of the respondents.

Variables	Categories	Frequency	Percentage
Age	15-24 years	243	35.4%
	25-34 years	244	35.5%
	35-44 years	119	17.3%
	45-54 years	67	9.8%
	55-64 years	12	1.7%
	65 years and above	2	0.3%

 doi:10.20944/preprints202407.0664.v1

Gender	Male	629	91.6%
	Female	58	8.4%
Marital Status	Single	206	30.0%
	Married	471	68.6%
	Divorced	10	1.5%
Race	Pashtun	672	97.8%
	Tajik	4	0.6%
	Hazara	4	0.6%
	Others	7	1.0%
No. of Household Members	1-4	82	11.9%
	5-9	151	22.0%
	10-14	183	26.6%
	15-19	71	10.3%
	20 and above	200	29.1%
Member of any Association	Yes	179	26.1%
	No	508	73.9%

3.2. Socioeconomic Characteristics of Agroforestry Communities in Khost Province

Frequency distribution was designed to describe the frequency and percentage of respondents across different socioeconomic characteristics (Table 3). Results indicated that one-third of the respondents studied till secondary school (33.2%), followed by respondents who studied till college/ university (24.0%) or had no formal education (23.0%). Regarding economic activity, approximately half of the respondents (50.4%) were self-employed. The remaining half included government employees (15.4%), NGO workers (13.1%), and farmhands (11.4%). Additionally, about half of the respondents (49.1%) had 1 to 5 years of work experience, followed by 6 to 10 years (27.1%), and 11 to 15 years (18.2%). Concerning income, nearly half of the respondents (42.1%) earned less than AFG 5000 per month. The percentage of respondents decreased notably as monthly income increased. Finally, a substantial portion (44.5%) reported a monthly household income below AFG 15,000, 19.4% had an income ranging from AFG 16,000 to AFG 20,000, and 10.6% reported an income between AFG 26,000 and AFG 30,000.

Hence, it is evident from the frequency distribution that most of the respondents had studied till secondary school (33.2%), were self-employed (50.4%), working for 1 to 5 years (49.1%), earned less than AFG 5000 monthly (42.1%), and had a monthly household income of less than AFG 5000 (44.5%). Overall, income, education, employment level, working experience, monthly income, and monthly household income provide a nutshell of the socioeconomic characteristics of agroforestry communities in Khost Province.

Table 3. Socioeconomic characteristics of the respondents.

Variables	Categories	Frequency	Percentage
Education Level	No Formal Education	158	23.0%
	Primary School	90	13.1%
	Secondary School	228	33.2%
	College/University	165	24.0%
	Master	44	6.4%
	Ph.D.	2	0.3%
Job/Employment	Self-Employed	346	50.4%
	Working at NGOs	90	13.1%
	Working at a farm	78	11.4%
	Government Servant	106	15.4%
	Others	67	9.8%
Working Experience	1-5 years	337	49.1%

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	6-10 years	186	27.1%
	11-15 years	125	18.2%
	16 years and above	39	5.7%
Monthly Work Income	AFG 5000 and below	289	42.1%
	AFG 6000 – AFG 8000	165	24.0%
	AFG 9000 – AFG 10000	118	17.2%
	AFG 11000 – AFG 15000	73	10.6%
	AFG 16000 and above	42	6.1%
Monthly Household Income	AFG 15000 and below	306	44.5%
	AFG 16000 – AFG 20000	133	19.4%
	AFG 21000 – AFG 25000	55	8.0%
	AFG 26000 – AFG 30000	73	10.6%
	AFG 31000 – AFG 35000	48	7.0%
	AFG 36000 – AFG 40000	43	6.3%
	AFG 41000 and above	29	4.2%

3.4. Comparison of Satisfaction Level Across Forest Products And Vegetable Farming

The MANOVA was performed to compare satisfaction with the level of facilities and infrastructure, factors of land use change, and impact of land use change across forest products and vegetable farming (Table 4 & 5). Meanwhile, univariate ANOVA was conducted to compare knowledge of land use change across forest products and vegetable farming. The significance of facilities and infrastructure across different products, how changes in land use were associated with the generation of different products, which factors relating to land use change were significantly affected on the generation of different products, and how positive and negative impact of land use change linked to the generation of different products was defined with the analysis. Regarding forest products, fruits and berries were significantly related to basic and advanced satisfaction with the level of facilities and infrastructure [Fruits: Wilk's Lamba = 0.973, F (2, 260) = 3.61, p < 0.05, Berries: Wilk's Lamba = 0.973, F (2, 260) = 3.56, p < 0.05]. Mushrooms, berries, and wild animals were significantly associated with natural and artificial factors of land use change [Mushrooms: Wilk's Lamba = 0.966, F (2, 260) = 4.60, p < 0.05, Berries: Wilk's Lamba = 0.896, F (2, 260) = 15.13, p < 0.001, Wild Animal: Wilk's Lamba = 0.969, F (2, 260) = 4.22, p < 0.05]. Furthermore, pine nuts, berries, wild animal, and timber were significantly linked to positive and negative impact of land use change [Pine Nuts: Wilk's Lamba = 0.954, F (2, 260) = 6.24, p < 0.01; Berries: Wilk's Lamba = 0.899, F (2, 260) = 14.55, p < 0.001; Wild Animal: Wilk's Lamba = 0.971, F (2, 260) = 3.84, p < 0.05; Berries: Wilk's Lamba = 0.968, F (2, 260) = 4.23, p < 0.05]. Based on the results derived from univariate ANOVA, herbs, mushrooms, wild animals, oils, wood, and honey were significantly related to knowledge of land use change and impacts [Herbs: F (1, 274) = 3.27, p < 0.01, Mushrooms: F (1, 274) = 3.15, p < 0.01; Wild Animal: F (1, 274) = 3.13, p < 0.01; Oils: F (1, 274) = 3.25, p < 0.01; Wood: F (1, 274) = 5.05, p < 0.001; Honey: F (1, 274) = 3.81, p < 0.001].

Table 4. Comparison of satisfaction with the level of facilities and infrastructure, knowledge of land use change & impacts, factors of land use change & impact of land use change across forest products.

	Satisfaction with Level of Facilities and Infrastructure	Knowledge of Land Use Change & Impacts	Factors of Land Use Change	Impact of Land Use Change
	MANOVA F (p-value)	Univariate ANOVA F (p-value)	MANOVA F (p-value)	MANOVA F (p-value)
Intercept	3444.89 (< 0.001)***	1149.04 (< 0.001)***	3463.16 (< 0.001)***	4508.02 (< 0.001)***
Herbs	0.49 (0.614)	3.27 (0.004)***	1.93 (0.147)	2.69 (0.070)
Mushrooms	1.45 (0.238)	3.15 (0.005)**	4.60 (0.011)*	1.92 (0.149)
Fruits	3.61 (0.028)*	1.00 (0.424)	0.61 (0.542)	0.57 (0.568)

Pine Nuts	0.53 (0.588)	2.08 (0.056)	1.33 (0.267)	6.24 (0.002)**
Berries	3.56 (0.030)*	2.02 (0.063)	15.13 (< 0.001)***	14.55 (< 0.001)***
Wild Animal	0.51 (0.599)	3.13 (0.006)**	4.22 (0.016)*	3.84 (0.023)*
Food Crops	0.92 (0.402)	1.18 (0.316)	0.09 (0.913)	0.26 (0.771)
Decorative Material for Craft	0.19 (0.825)	1.35 (0.236)	0.64 (0.525)	1.77 (0.172)
Timber	0.20 (0.818)	1.80 (0.099)	2.84 (0.060)	4.23 (0.016)*
Oils	0.24 (0.791)	3.25 (0.004)**	2.64 (0.073)	1.14 (0.322)
Wood	2.46 (0.088)	5.05 (< 0.001)***	0.04 (0.960)	2.20 (0.113)
Honey	0.28 (0.754)	3.81 (0.001)***	1.39 (0.251)	2.52 (0.083)

* p < 0.05, ** p < 0.01, *** p < 0.001.

A detailed analysis conducted with tests of the between-subject effects implied that berries and fruits only caused satisfaction with advanced facilities and infrastructure (Berries: $\beta = -0.226$, $p < 0.05$, Fruits: $\beta = -0.263$, $p < 0.05$). Regarding natural and artificial factors of land use change, mushrooms were associated with the development of planted forests, hydroelectric dams, agricultural activities, and government policy ($\beta = -0.299$, $p < 0.01$) but did not relate to logging ($\beta = 0.313$, $p = 0.157$). Additionally, berries were related to logging ($\beta = -1.106$, $p < 0.001$) and the development of planted forests, hydroelectric dams, agricultural activities, and government policy ($\beta = 0.245$, $p < 0.05$). Lastly, wild animals were highly related to logging ($\beta = 0.627$, $p < 0.01$). Regarding the impact of land use change, pine nuts only caused the negative impact of land use changes ($\beta = -0.223$, $p < 0.05$). Berries, wild animals, and timber positively (Berries: $\beta = -0.282$, $p < 0.05$; Wild Animal: $\beta = 0.324$, $p < 0.01$; Timber: $\beta = 0.333$, $p < 0.05$) and negatively (Berries: $\beta = -0.524$, $p < 0.001$; Wild Animal: $\beta = 0.202$, $p < 0.05$; Timber: $\beta = 0.300$, $p < 0.01$) impacted land use change.

Table 5. Comparison of satisfaction with the level of facilities and infrastructure, knowledge of land use change & impacts, factors of land use change & impact of land use change across vegetable products.

	Satisfaction with Level of Facilities and Infrastructure	Knowledge of Land Use Change & Impacts	Factors of Land Use Change	Impact of Land Use Change
	MANOVA F (p-value)	Univariate ANOVA F (p-value)	MANOVA F (p-value)	MANOVA F (p-value)
Intercept	4314.99 (< 0.001)***	9144.35 (< 0.001)***	4662.12 (< 0.001)***	5169.44 (< 0.001)***
Zucchini	0.23 (0.791)	2.39 (0.122)	0.06 (0.942)	2.93 (0.054)
Yellow Pumpkin	1.11 (0.330)	0.10 (0.750)	2.36 (0.095)	0.580 (0.451)
Lettuce	1.62 (0.198)	0.52 (0.472)	0.07 (0.936)	1.23 (0.293)
Pepper	0.13 (0.883)	0.03 (0.862)	2.41 (0.091)	3.06 (0.048)*
Potato	2.19 (0.113)	1.13 (0.288)	2.54 (0.080)	1.33 (0.265)
Onion	0.70 (0.496)	0.11 (0.742)	2.33 (0.098)	2.96 (0.053)
Pumpkin	1.89 (0.153)	0.25 (0.617)	0.85 (0.427)	0.90 (0.406)
Turnip	0.20 (0.822)	2.42 (0.120)	0.28 (0.754)	0.46 (0.632)
Okra	2.26 (0.106)	4.02 (0.045)*	0.76 (0.467)	2.96 (0.053)
Garlic	1.85 (0.158)	0.03 (0.855)	1.06 (0.347)	0.19 (0.830)
Eggplant	2.26 (0.105)	9.30 (0.002)**	6.10 (0.002)**	1.81 (0.165)
Carrot	1.92 (0.148)	5.73 (0.017)*	4.39 (0.013)*	1.26 (0.285)
Watermelon	1.83 (0.161)	0.67 (0.415)	0.63 (0.532)	0.39 (0.676)
Melon	0.67 (0.513)	0.52 (0.472)	1.10 (0.334)	0.34 (0.713)
Cucumber	4.13 (0.017)*	0.12 (0.728)	4.58 (0.011)*	1.63 (0.197)

* p < 0.05, ** p < 0.01, *** p < 0.001.

With regards to vegetable farming, the MANOVA outcomes implied that cucumber was significantly related to satisfaction with basic and advanced levels of facilities and infrastructure [Wilk's Lamba = 0.988, $F (2, 260) = 4.126$; $p < 0.05$]. Moreover, cucumber was significantly linked to natural and artificial factors of land use change [Wilk's Lamba = 0.988, $F (2, 260) = 4.126$; $p < 0.05$]. Loquat was significantly related to the positive and negative impact of land use change [Wilk's Lamba = 0.991, $F (2, 260) = 3.06$, $p < 0.05$]. Meanwhile, the univariate ANOVA results indicated that only okra, eggplant, and carrot were significantly related to knowledge of land use change and impacts [Okra: $F (1, 687) = 4.02$; $p < 0.05$; Eggplant: $F (1, 687) = 9.30$; $p < 0.01$; Carrot: $F (1, 687) = 5.73$; $p < 0.05$].

A detailed analysis using tests of the between-subject effects indicated that cucumber only caused satisfaction with basic and advanced levels of facilities and infrastructure (Ba-sic: $\beta = -0.298$, $p < 0.01$; Advanced: $\beta = -0.231$, $p < 0.05$). Eggplant, carrot, and cucumber only caused artificial factors of land use change (Eggplant: $\beta = -0.298$, $p < 0.01$; Carrot: $\beta = -0.231$, $p < 0.05$; Cucumber: $\beta = -0.231$, $p < 0.05$), while pepper only caused the negative impact of land use change ($\beta = 0.224$, $p < 0.05$).

4. Discussion

While examining the socioeconomic factors and exploring the satisfaction level of forest products and vegetable farming of agroforestry community of Khost Province, Afghanistan, the study found that certain crops are more suitable to grow due to the changes in the land use, climate change, changes in facilities and infrastructure, locals' knowledge of land use change and impacts, natural and artificial factors of land use change, and positive and negative impact of land use change. These crops include fruits, berries, timber, oils, wood, honey, wild animals, herbs, mushrooms and pine nuts among forest products, while pepper, eggplant, carrot and cucumber among vegetable farming. Focus on these crops can generate more produce and more income for the local agroforestry community of Khost Province, Afghanistan.

As opposed to mono-cropping, multicropping and multipurpose trees under agroforestry process and procedure can have more economic and environmental benefits due to the land use change. The deployment of intercropping and agroforestry can be adapted to encounter the challenges and negative factors of land use change, including the availability and accessibility of vegetables and forestry products. [28] explained that cultivating one crop on a certain land is a risky, paricularly in drought conditions and climate and market uncertainty. The best strategy is to move towards agroforestry, which can be an economically efficient diversification strategy. While adapting towards economies of scale and scope, it is best to interact between trees and crops, which will generate higher income and produce for the local community.

Considering the availability of facilities and infrastructure in Khost Province, Afghnistan, it is best to produce fruits, berries, and cucumber among all vegetable and forestry products as found to have more satisfactory results as compared to all products. Moreover, it is best to produce herbs, mushrooms, wild animals, oil, wood, honey, okra, eggplant and carrot among all vegetable and forestry products as found to be more productive based on locals' knowledge about land use change. In terms of factors of land use change including the changes in logging, development of planted forest and hydroelectric dam, agricultural activities, and change in government policy, it is best to produce mushrooms, berries, wild animals, eggplant, carrot, and cucumber to maximize the economic and environmental benefits of these factors. Lastly, in term of impact of land use change such as the availability of fruits, wild animals and river sources, as well as suitability of prices, availability of consumers, and presence of job opportunities, it is best to pine nuts, berries, wild animal, timber, and pepper to maximize the benefits from economic change. Farmers can rely on these crops to cope with the challenges, impacts, and factors of land use change in Khost Province, Afghanistan. Cultivation of these crops are also beneficial to cope with the changes in soil nutrition and fertilization value of soil.

While examining the socioeconomic characteristics of Khost Province, Afghistan, the study found that mostly people are studied till secondary school. Almost half of the population are self-employed with an experience of 1 to 5 years of experience and with a monthly income of less than

AFG 5000. The monthly household income of these people is below AFG 15,000. A majority of the population in Khost Province, Afghinstan rely on agricultural activities as their main source of livelihood. Overall, income, education, employment level, working experience, monthly income, and monthly household income provide a nutshell of the socioeconomic characteristics of agroforestry communities in Khost Province. Hence, it can be agrued that agroforestry is a best possible adaption strategy towards land use changes in Khost Province, Afganistan.

5. Conclusions

The study aims to examine the socio-economic characteristics and compare the statisfaction level across forest products and vegetable farming of agroforestry community in Khost Province. This study also highlights the significant influence of agroforestry practices on the socioeconomic development of communities in Khost Province, Afghanistan. It highlights the requirement to consider ecological factors and various influences on the region's agroforestry-related socioeconomic conditions. The study observed that changes in land use and associated knowledge significantly affected forest products such as herbs, mushrooms, wild animals, oils, wood, honey, and vegetable products like okra, eggplant, and carrots. Moreover, satisfaction with the level of facilities and infrastructure notably impacted fruits, berries among forest products, and cucumber among vegetable products. Natural and artificial factors of land use change affected forest products such as mushrooms, berries, wild animals, and vegetable products like eggplant, carrot, and cucumber. Notably, positive and negative impacts of land use change significantly affected forest products including pine nuts, berries, wild animals, timber, and agricultural products like pepper. Due to land use change, agroforestry can be economically efficient diversification strategy as opposed to mono-cropping systems. Multicropping and intercropping are some of the promising strategies to cope with the land use changes, changes in soil nutrients and pH value, changes in facilities and infrastructure, and various other factors associated with the changes in land use. These findings offer valuable insights for policymakers and practitioners to devise strategies for sustainable agroforestry, aiming to elevate the socioeconomic status of communities. This study enriches existing literature on rural development and resource management by scrutinizing how various agroforestry products influence the social and economic dynamics. Collaboration among agencies, local authorities, and community representatives is essential for improving community facilities and infrastructure, thereby enhancing living conditions and fostering sustainable development. Initiatives such as knowledge-sharing sessions and increased market access for agroforestry products can create additional income avenues for community members. Future studies could replicate the study in other Afghan areas and provinces would enhance generalizability. Interviews with farmers and agroforesters could offer valuable insights into practices, their potential benefits, and drawbacks, augmenting research objectivity and practicality.

6. Limitations

This study encountered several limitations. First, this work primarily focused on the change in land use and its effects on agroforestry. Future studies could examine agroforestry in terms of climate change, national economic conditions, regulatory systems to support the national agroforestry system, market fluctuations, and other associated factors. Second, the study area was restricted to Khost Province, Afghanistan, with each district demonstrating varying levels of soil nutrition, soil moisture, temperature, and precipitation. Third, it was considered challenging to adopt a well-established questionnaire that measures the socioeconomic characteristics of agroforestry-dependent communities. Fourth, the survey data were influenced by selection bias, which can affect outcome generalizability. Fifth, the empirical data were generally collected from small-scale or large-scale farmers, which could influence the socioeconomic impacts of their agroforestry practices. Moreover, stratified samplinf was applied on the study population of each districts, which include children and infants that are yet to select an occupation. Oversimplication may urge to apply different sampling technique such as purposive sampling or other non-probability sampling for the calculation of sample size. Furthermore, the cross-sectional design of this study rendered it impossible to examine

 doi:10.20944/preprints202407.0664.v1

the impact of land use change and agroforestry practices on the socioeconomic factors over a decade. Lastly, this study solely focused on farmers' and agroforesters' current socioeconomic attributes. This limitation may pose new challenges to land use and climate change and shifts in temperature and precipitation, which were not included in the current study scope.

Author Contributions: Data curation, M.R.A.; formal analysis, M.R.A.; funding acquisition, M.R.A. and M.H.I.; investigation, M.R.A.; methodology, M.R.A.; resources, M.R.A, and M.H.I.; supervision, P.B.H.Z., M.H.I.; writing—original draft, M.R.A.; writing—review & editing, P.B.H.Z., M.H.I., M.M.M, and P.B.B.; All authors have read and agreed to the published version of the manuscript.

Funding: Please add: This study was supported by grants from the Afghanistan Research Initiative (ARI) at the University of Central Asia, funded by Canada's International Development Research Centre (IDRC) and the Aga Khan Foundation Canada (AKFC). The grants were awarded to Ahmadzai Mujib Rahman, a Ph.D. scholar at the University of Putra Malaysia. The authors are grateful to ARI and AKFC for their financial support.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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